MULTIMEDIA UNIVERSITY

STUDENT IDENTIFICATION NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 2, 2017/2018

BDE 2014 – DIFFERENTIAL EQUATIONS

(All Sections / Groups)

12 March 2018
9 a.m. – 11 a.m.
(2 Hours)

INSTRUCTIONS TO STUDENT

1. This question paper consists of 2 pages.
2. Attempt all 4 questions. The distribution of marks for each question is given.
3. Students are allowed to use scientific calculators.
4. Please write your answers in the **Answer Booklet** provided.

Question 1 [Total = 25 marks]

a) Classify the following differential equations according to order and linearity:

(i) $8\frac{d^4y}{dx^4} = x(1-x)$

(ii) $y\frac{dy}{dx} + (\sin x)y^2 = e^x + 1$

(iii) $\frac{\partial N}{\partial t} = \frac{\partial^2 N}{\partial t} + \frac{1}{t}$

[6 marks]

b) Solve the following implicit differential equation:

$$\frac{dy}{dx} = 4x^3y - y \quad \text{where} \quad y(1) = -3$$

[9 marks]

c) For the following differential equation:

$$(3x^2 + 2y^2)dx + (4xy + 6y^2)dy = 0$$

(i) Show that the differential equation (DE) is exact.
(ii) Find the solution to the exact DE.

[10 marks]

Question 2 [Total = 25 marks]

a) Consider the following differential equation (DE):

$$xy' + y = 3xy$$

(i) Rewrite the DE in the form of $\frac{dy}{dx} + p(x)y = r(x)$.
(ii) From (i), find its integrating factor.
(iii) Hence, find the general solution of the DE.

[10 marks]

b) For the following differential equation(DE), solve the DE using **undetermined coefficients- superposition approach**:

$$y'' - y' - 6y = 2\sin(3x)$$

(i) Find the complementary function, y_h of the above DE.
(ii) Find the particular function, y_p of the above DE.
(iii) Find the general equation, y of the above DE.

[15 marks]

Continued...

Question 3 [Total = 25 marks]

a) Solve the following homogeneous differential equations:

(i) $y''-8y'+16y=0$

(ii) $y''+4y'+5y=0$

[10 marks]

b) Find the general solution for the following non-homogenous **Cauchy-Euler** equation by using **variation of parameters method**:

$$x^2y''-6xy'+8y=8x^6$$

[15 marks]

Question 4 [Total = 25 marks]

a) Classify the given partial differential equation as hyperbolic, parabolic or elliptic:

(i) $\dfrac{\partial^2 u}{\partial x^2}+3\dfrac{\partial^2 u}{\partial x\partial y}+4\dfrac{\partial^2 u}{\partial y^2}+\dfrac{\partial u}{\partial x}-6\dfrac{\partial u}{\partial y}=0$

(ii) $a^2\dfrac{\partial^2 u}{\partial x^2}=\dfrac{\partial^2 u}{\partial y^2}$, $a\neq 0$

(iii) $\dfrac{\partial^2 u}{\partial x\partial y}-\dfrac{\partial^2 u}{\partial y^2}+2\dfrac{\partial u}{\partial x}=0$

[9 marks]

b) Find a partial differential equation by eliminating the arbitrary function f from the relation:

$$z=f(x^2-2y^2)$$

[8 marks]

c) Find a partial differential equation by eliminating the arbitrary constants a and b from the relation:

$$ax^2-by^2-z^2=5$$

[8 marks]

End of paper